FAQ are divided in to two parts one is for manufacturer and other for ATEs/CBs as following

- *** Is for Manufacturer**
- **** Is for ATEs/CBs**
- **Without * is for both ATEs/CBs and Manufacturer**

1. General

1.1 Is hexacopter configuration mandatory for agriculture spray drones, or quad configuration is also allowed?(*)

For configuration there are no limiting conditions specified in the criteria towards its Application.

1.2 Is CG calculated by software based on RM data sufficient or manufacture have to go for physical testing of drones? (*)

It is a calculation with reference to a datum point.

1.3 Would static analysis of airframe using finite element analysis (FEA) software for flight limit loads be adequate for compliance?

Static Test to limit load is the basic requirement in Certification Scheme where means of compliance is Static Load test report. Calculation of max flight loads and initial estimation of structural strength, appropriate software or FEA analysis can be used. Demonstrate would generally mean proving through actual test. Demonstration of this criteria requirement is applicable to medium and above classification of drones (if Composite used in airframe). For small and below, theoretical calculations as stated above would suffice.

1.4 What should be the approach to find life of UAS? Or, how to specify propeller life, as it is difficult to get it from OEM? Is there any standard method to calculate it?(*)

The lifespan of drone is determined by the manufacturer; the age is calculated based on flying cycles. As a rule of thumb, each cycle involves “take off/landing.” Fuselage and wings (fixed, rotary) are subjected to stress. Based on design review, validation by tests and experience, life of Drone could be decided by the manufacturer. Appropriate software can also be used for life calculations based on calculated flight loads on the drone.

1.5 What is the best approach to find number of permissible landing of Quadcopter?(*)

The lifespan of drone is determined by the manufacturer; the age is calculated based on flying cycles. As a rule of thumb, each cycle involves “take off/landing.” Fuselage and wings (fixed, rotary) are subjected to stress. Based on design review, validation by tests and experience, life of Drone could be decided by the manufacturer.

1.6 If manufacturer can submit enough flight logs conducted across a long time period, can that be considered for the life of UAS justification?(**)

Yes that is acceptable, but extrapolation would not be permitted.

1.7 Will CB do independent tests to verify the life of UAS?(**)
No, CB will not do independent testes

1.8 CG of aircraft change as per the payload distribution but in terms of multi-rotor, whereas if the design is symmetric about x and y and the payload falls directly at the center point of the symmetric axis which is CG of x and y, is it correct to write the basic formula to complete this or else you can get this thing automatically from design software when the product and assembly w.r.t to material is complete?(*)
Calculations of CG using appropriate software are also acceptable. But the same sought to consider all the possible configurations of the drone payloads including variable ones such as liquids that will be off-loaded during applications.

1.9 In case of delivery drones, payload weight and type of payload will be different, what is the process for that?(*)
The calculation is done based on empty weight, all up weight (MTOW). The payload weight may vary the operational envelop (Range). The manufacturer should prepare a chart (V-n diagram) to address this issue and it should be part of flight manual.

1.10 What if the operator wants to integrate a new payload under guidance of the manufacturer but it was not listed during initial Certification which was done by manufacturer, does the payload be of the same category as declared by manufacturer?(**)
After the initial design approval by the design approving authority-DGCA, any upgrade, change to the product resulting in design and configuration changes should be submitted to the authority for approval of the changes. As far as certification is concerned, CB will verify compliance with respect to the changes incorporated and the certification will remain valid.

1.11 Is swappable payload allowed or not?(*)
All applications of payload(s) should be included in the initial request for certification. However swappable payload doesn't make appreciable changes in the configuration of UAS.

1.12 Based on the AUW, the thrust to weight ratio varies so if you increase the AUW the ratio automatically varies and hence affects the performance of your quad.(*)
That is why, performance is calculated based on Max AUW as well.

1.13 To consider 1.5 safety factor is for hover thrust or for maximum thrust?
Max Thrust.

1.14 The tests mentioned for CB are to be done on all categories of Drones, viz. Micro, Small, and Medium category? Or any category is exempted from these tests?
Yes. No distinction in scheme for different categories.

1.15 As per technical requirements of UAS: clause 1.5 – Evaluating the life of an airframe Whether to evaluate the airframe a specific fatigue test needed to be conducted?(**)
It may be the cyclic fatigue test. But, for clause 1.5 requirements, theoretical analysis/simulation will also suffice the purpose.

1.16 Whether OEM reports for life cycle of UAS components is acceptable as evidence of compliance for clause 1.5 ?(**)
Internal analysis report referring OEM report with adequate justification attached with OEM report can be submitted as evidence.

1.17 Can a model be certified with a different payload configuration which changes the category of the model? (*)
No, a payload configuration should not change the category of the model, if it is changing then model will dealt as a separate model & manufacturer should apply separate application for the other model.

1.18 For Clause 1.6 Payload (Multiple):
A: How to handle multiple payload configuration in a drone?
B: Can a manufacturer add multiple payloads in a UAS model?
A&B: A manufacturer is free to add multiple payloads in a UAS Model provided that the addition or removal of such payload does not change the fundamental performance characteristics or behavior like:
a. Category of the UAS
b. Major deviation of MTOW
c. Major deviation in C.G and it's limits
d. Major deviation of Endurance

1.19 How to calculate the Life of UAS ?
The maximum life may be calculated using the following logic:
a. Maximum life of airframe by FEA
b. Reduce the same for factor of safety of 1.5x
c. Calculate operational life of UAS with respect to other components
d. Operational life can be extended based on maintenance and overhauling of all components except airframe.
e. Manufacturer may update the life of the UAS based on experience during certification amendment or recertification.

1.20 How to calculate the Life of UAS through FEA?

a. While providing the FEA for life of airframe, manufacturer to clarify why they choose FEA (because there is no other means of compliance).
b. In the design document, manufacturer to define the flights load; points where the load applies; with the explanation as of why is it applicable. ATE to verify the same.
c. Using FEA as a reference, determine the life of airframe and provide justification of the value with applied Factor of Safety and harmonies the term of reference in hours/years
d. Number of Maximum Permissible Landings; manufacturer to define the method i.e., shock absorption mechanism reducing the impact load; justify the height i.e., with the flight controller; FEA or drop test is accepted with suitable justification and methods not limited to as mentioned above. ATE to verify

2. Performance

2.1 Whether Range & Endurance is a factor of MTOW? What payload needs to be made available for the calculation of range & endurance (no payload or max payload?) (*)

Yes. Range as well as endurance is with MTOW. Also, for MTOW, it is with that configuration of payload, which has Max Weight.

2.2 What is the minimum requirement of a spraying drone considering that spraying will be done over a field at the height of 5 meter in a far off area? What waivers are there for spraying drones?(**)
Current Certification criteria is for the performance of the drone. As regards its application and its performance in respective applications such as spraying etc. the same needs to be specified by the manufacturer being the OEM. There are no waivers in the certification requirements as these are the minimum standards for safety and reliability.

2.3 What is the performance based parameters, for early stage start-ups, there is not enough equipment for these internal testing? (**)
These are performance based parameters determined through calculations and flight testing.

2.4 How can the max altitude test be done, as DGCA approved only 400 ft. for drones?(**)
Manufacture need to determine by calculation the max attainable altitude as per their design. 400 ft is the limit. The firmware should restrict the drone within that limit.

2.5 What altitude endurance test will be done?(**)
It will be done on Operational altitude.

2.6 If 95 KJ is the max. Kinetic energy, will that not remove the need for parachutes and other recovery systems? Because, for weights less than 25kg, kinetic energy will be much less than that even in case of freefall.(*)
Yes. As per calculations of Max KE, if it is less than 95 KJ, there would be no need for recovery systems such as Parachutes etc. However, for drones having larger Max AUW, it would be necessary to arrest the Max KE below the permitted value using appropriate recovery systems

2.7 What all parameters are expected to be declared for the operational envelope?(**)
Operational envelope is related to the boundary conditions of flight with reference to and combination of Max All Up Weight, Centre of Gravity, Altitude, Temperature and Air Speed.

2.8 Would vibration analysis of airframe using finite element analysis (FEA) software for flight limit loads be adequate for compliance? Or, ground test \ flight test data is also required?(*)
Flight test data for vibration analysis is also required since witness by assessment team during flight test validation. The test for any operational speed and power condition.

2.9 For quadcopter during hovering does not change locations, speed = distance/time, as the distance is zero, the speed is zero, we can provide the minimum RPM requirement, is that okay for minimum speed.(*)
The minimum operating speed of the rotor should be considered which is needed for supporting the drone while airborne i.e. minimum RPM

2.10 Airframe static testing is mandatory for medium classified UAS. In this regard, whether airframe static testing can be performed as mentioned below –

a. Can manufacturer perform the test with **maximum operating load of motor-propeller combination in UAS POWER ON mode** by constraining the airframe at landing gear?

Test can be performed with Maximum take of weight of UAV, Drop test can be done both ways, landing gear with appropriate ballast weight representing a configuration of UAS or an assembled landing gear on the UAS. The test is for the Landing gear

b. Can manufacturer assume flight limit load is the maximum operating load of the propulsion system in service (motor-propeller combination)?
Maximum Limit load can be (factor of safety*maximum take-off weight of the UAV)

In Certification Scheme for UAS, Part-3 Certification Criteria, Annexure-A Technical Criteria 4.4.1 “Static test to limit load based on maximum all up weight.”
Regarding the static load, this test is for the strength of the structure. Manufacturer need to apply static load of an appropriate value for a specified time on Primary Structure Elements. Assumption of flight limit load as max operating thrust of power plant and constraining the airframe at landing gear may not appear to be correct.

c. Also, can this test be applicable for "Determine integrity of propeller and its mounting at maximum rpm" criteria?
Separate test can be done as describe in In Certification Scheme for UAS, Part-3 Certification Criteria, Annexure-A Technical Criteria 2.2.7 (b), Regarding integrity of propeller at Max rpm, the suggested test can be considered with due inspection of the propeller assembly after the test.

2.11 The performances can be witnessed only by fixing sensors across various portions of the airframe. Is that what is expected from manufacturers as part of the process?(*)
Yes. Sensors along with appropriate instrumentation for display and recording.

2.12 How to determine the stability of UAS?(*)
Manufacturer to define in design documents, the stability of the system with reference to parameters like CG, vibrations and user control. The same shall be demonstrated by the manufacturer to be within limits during stage 2 flight test and substantiate using flight logs that is in readable format.

3. Powerplant

3.1 For R&D validation purposes, Manufactures have to import the different configurations of batteries from different OEMs. So getting BIS for every individual is challenging for manufactures. How can we ease that process?(*)
For R&D, compliance requirements in the scheme are little different. R&D is considered as an in-house activity which is out of the purview of the certification. However, for certification of any drone model, BIS registration of the battery would be required.

3.2 Has there been any guidance from MeitY on clarifying which class of UAVs (Nano, Micro, Small, etc.) would the BIS compliance for portable batteries be applicable to?(*)
As of now MeitY has not issued any separate guidance for UAV. The guidance is for Lithium batteries used in equipment. As per the guidelines, Lithium batteries should be BIS registered. Hence it applies to UAVs also.

3.3 Which branded batteries are already BIS certified which we can use directly by procuring them from the Manufacturer?(*)
This information is available on the BIS website. Manufacturers can choose the battery as per their requirements.

3.4 For BIS certifications, how many battery packs need to be submitted to NABL lab?(*)
This is as per BIS registration requirement and not part of the scheme.

3.5 What is the validity and renewal period of R- Number by BIS?
Validity of licence
(1) The licence to use Standard Mark shall be granted initially for two years.
(2) The licence may be renewed for a further period not less than two years and up to five years.

Kindly visit the below link for the validity, refer page no. 224
https://www.crsbis.in/BIS/app_srv/tdc/gl/docs/BIS_Conformity_Assessment_Regulation_2018_Gazette_Notification.pdf

Kindly visit the below link for the Renewal
https://www.crsbis.in/BIS/app_srv/tdc/gl/docs/Guidelines_Renewal_Licence.pdf

Kindly visit the below link for verifying the validity of R. number
https://www.crsbis.in/BIS/Lims_registrationc.do?hmode=getLimsData

3.6 If cell is BIS approved, do manufacture is still need to get Battery Pack certified?(*)
Yes. Registration of battery packs is required.

3.7 Should BIS certification be taken by importer or manufacturer of batteries? Drone manufacture should not be burdened with this certification.
As per the scheme, batteries used in UAS should be BIS registered. Designating the responsibility of getting batteries registered to importer / manufacturer is beyond the scope of the scheme owner.

3.8 Is BIS Certification mandatory for batteries or lab test reports will suffice?(*)
BIS registration of batteries used in UAS is mandatory to avoid usage of substandard batteries/unreliable battery.

3.9 How to ensure that motor/motor controller overcurrent and overheating protection?
Manufacturer may specify values from the datasheet of the ESC. In case the ESC is manufactured in-house, then the test reports of the same may be attached.
During stage 2 – a bench test may be conducted for verifying the values by ATE that is specified by the manufacturer.

3.10 How to determine the (depth of discharge) lifecycle of battery?
Manufacturer may define average discharge current by analysis assuming the performance of the UAS. This average value of current consumption defined by the manufacturer can be used for lifecycle test of the battery. Flight logs submitted as proof should be in readable format.

3.11 Is there any guidelines for battery ? Yes
(General Battery testing guidelines)

4. Structure

4.1 Should we perform simulation or physical test or lab test to find number of permissible landing and life of structure?(*)
Carrying out simulation using software is a tool for design review. The lifespan of drone is determined by the manufacturer, the age is calculated based on flying cycles. As a rule of thumb, each cycle involves “take off/landing.” Fuselage and wings (fixed, rotary) are subjected to stress. Based on design review, validation by tests and experience, life of Drone could be decided by the manufacturer. Determination of life using simulation tools is acceptable.

4.2 What about the strength of moving parts of a drone's structure? (like grippers or moving arms)(*)
One of the best practices of aviation industry is to categorise all parts into three groups namely: Class-I, Class-II and Class-III. Parts that are structurally significant and subjected to stress during life cycle of the product and failure of such parts will lead to catastrophic failure of the UAS are grouped as Class-I Parts. The parts whose failure may not lead to catastrophic failure of the UAS but will make it grounded for repair and maintenance are grouped as Class-II Parts. All other less significant items (bolts, nutst and parts, simple bracketry items) will be grouped as Class-III Parts. Class-I and Class-II parts are important from the strength point of view and hence care need to be exercised right from material selection, design, design review, manufacturing process, inspection and quality control, test and validation.

4.3 The flight envelope of commercial aircraft is different as compared to unmanned aircraft. Flight development means I'm talking about the V-n curve. Do we have any standard to demonstrate that a particular class of UAV must follow the same envelope?(*)
There is no standard specified. In simple terms, it is the boundaries of flight in limiting conditions of specified parameters.

4.4 Is the Vibration level requirement specified for UAS and are there any tolerances with respect to Vibration?(*)
Manufacturer / designer should specify in the respective document and demonstrate accordingly

4.5 How to determine the vibration limit of UAS?
Manufacturers to define the value based on internal tests and calculations during design and development phase as justification for the value taken and the same may be verified (that they are within limits) by the ATE during stage 2 flight test substantiated using flight logs that is in readable format.

5. Material and Construction

5.1 Is there any kind of certification for the material used in the drone frame?(*)
Please refer S.N. 5.1 of the Technical criteria of the UAS Certification Scheme.

5.2 What all tests are required to be conducted in material tests?(*)
Physical properties and chemical analysis tests. If the raw-material supplier has conducted these tests and provided copies of test reports, that would be enough.Independent testing is necessary in the absence of manufacturer's test reports and re-testing unless so desired by the customer.

5.3 For the material selection, are the results or details obtained from the supplier on the material coupon tests (for composites) are enough? Or do CBs need another set of test during the independent or laboratory test stage of certification?(*)
For initial material selection, review of standard design data of the materials would be good enough. After procurement, Physical properties and chemical analysis tests. If the raw-material supplier has conducted these tests and provided copies of test reports, that would be enough. Independent testing is necessary in absence of manufacturer's test reports and re-testing unless so desired by the customer.

5.4 Is fatigue strength to be determined or is it only tensile/yield strengths only need to be demonstrated as per 5.1 of certification criteria?(*)
For primary structural elements, it should be the fatigue strength keeping Factor of Safety as mentioned

5.5 Can we take a 3D printed airframe, will it be feasible and what are the other tests which will be needed?
The suitability and durability of materials used for parts should ensure that strength and other properties of airframe, taking into account the effects of environmental conditions, such as temperature and humidity, expected in service

5.6 Can a 3D printed material be used for Airframe Structure?
3D printed material as well as manufacturing process/ fabrication method would need to be validated through
a. QC process specification and procedures for establishing consistency in quality of fabrication
b. An extensive test program followed by periodical Production Quality Tests (PQT) during bulk production.

6. Data Link

6.1 Does the 867-868 MHz band require a license to operate? (*)
This need to be confirm from WPC wing of DoT (Department of Telecommunications) in this regards.

6.2 Can manufacture use an ETA Certificate taken by some other company for the same product or do manufacture have to take our own ETA Certificate for that product? (*)
It can be used if the make, model, frequency, power and other relevant parameters of the equipment are same and also it is mentioned in the certificate of the first applicant that "It may be utilized by another person(s) for import/usage purpose in India".
If it is mentioned in the certificate that the ETA is for a particular make and model of UAV, then the certificate cannot be used for other make models of UAV.

6.3 For Data Link if manufacture use a license free band like 2.4 Ghz, do manufacture need

any permission/license from WPC?(*)
Yes, ETA certificate from WPC would be required. 2.4 GHz is mostly used for indoor wireless applications like LAN, Cordless Phones etc. for a maximum power output of 1W in spread of 10MHz or higher.

6.4 Is ANTI COLLISION light not mandatory for any category of drone?(*)
Mandatory for night flying. For day flying it's optional.

6.5 How to determine the flight capability system in the data link?
It's not a “flight capability system". Its data link capability which manufacturer has to specify as per the product parameters.

6.6 How to get the approval for TRANSMITTER and RECEIVER used in Drones?(*)
ETA Certificate from WPC DoT. Procedure mentioned in their website.

6.7 Which components require IS 13252 and IS 616 certifications?(*)
No component requires certification under IS 13252 and IS 616 standards. However, these standards could be used by the manufacturers as general safety guidelines for ensuring safety of electronics equipment, chargers, cable connections etc.

6.8 Do manufacture have marks associated during certification as there are various optional features like collision avoidance etc.?
No marks or grading is awarded during certification for any optional features incorporated in the UAS Certification Scheme.

6.9 If all parts are imported from Taiwan or China, how to get them certified? Also, how about the Ground Control Software as all of them will be in Chinese and English Language?(*)
It is the manufacturer’s prerogative to decide on import, country, buy or manufacture. Responsibility to get certification and details of the software from their suppliers for all applicable equipment intended to be used in the UAS lay with the manufacturer. The scheme owner has no scope to recommend in this regard.

6.10 For a data link test for all azimuth angles, what parameters are to be logged?
All parameters of the drone that are monitored during flying including the parameters of the data link.

6.11 Whether separate ETA approval is required for transmitter and receiver module?
Separate ETA approval is required only when transmitter and receiver are of different module/specification.

6.12 What is the validity and renewal of ETA Certificate?
Validity & Renewal of ETA Certificate is granted by WPC for a particular model therefore it is valid as long as the model is manufactured without any modifications. No renewal is required for WPC ETA Certificate.

7. Secure Flight Module (FM) and Tracking Mechanism

7.1 Do secure firmware upgrades with new hashes need to be authorized by CB before upgrade, or should it just be communicated to CB?
Any change to the certified firmware will void the certification. Prior authorization by CB

is recommended to maintain validity.

7.2 Is the verification of checksum the only way to POST? Or is it one of the way?
Power on Self-Test (POST) is a commonly accepted procedure to detect integrity of a system before use on powering up. Checksum comparison is the simplest of the techniques to see if software/firmware has been changed. If any other procedure is implemented, the onus of convincing the CB on acceptability of the method for preserving/detecting change in integrity of the firmware falls on the manufacturer.

7.3 Under Certification criteria 7.1, step 2 a. ii., code and data part's hash to be calculated separately. So the parameters of the flight controller come under data part of the firmware? If so, then manufacture have 50+ changeable parameters in which few might be changed before every flight (depending upon the scenarios). Now do manufacture have to calculate hash for every cases? Like manufacture have to perform permutations combination of the 50+ parameters and produce hash for every possible cases? (**)
Parameters used for compliance criteria are to be controlled. Variables used in flights are not included in this. Avoid getting into permutations of variables by including theboundary values as the parameters and for flight, use variables which would be checkedagainst the boundary conditions for compliance.

7.4 If every communication link going into the flight module is encrypted, is it necessary to have the data part in the firmware be digitally signed?
Yes. Tampering without using communication link is also possible when UAS is on ground.

7.5 Can the POST of checksum of data part be done as pre arm check instead of having on boot?(**)
Should be acceptable. Demonstrate that it is happening to the CB.

7.6 If secure upgrade is implemented, how will POST be demonstrated? Because POST verification will involve upgrading in an unauthorized manner.(**)
In the manufacturer’s site with a suitable test setup.

7.7 Is it recommended to protect the bootloader that is doing the POST test? Or, are we not at that level of protection?
Need to have protection for bootloader else entire POST results can be spoofed.

7.8 Checksum for firmware of Flight controllers has to check only on firmware upload or every power on?
Advisable to do it for every power on.

7.9 With respect to Hardware tampering, which modules would you consider as security critical – GPS or ESC or etc.?(**)
The registered flight module which is to function as root of trust is the most critical. Other modules are also relevant for security; their status can be checked by RFM once it is booted up.

7.10 Does the firmware checksum apply to the micro category as well?(**)
Firmware checksum (cryptographic hash) is also used as the identity of the firmware. CB would in fact refer to this identity in the certificate.

7.11 Does "verification key" here mean Public key?

Yes, the Verification Key means the Public Key.

7.12 What is method and format for submission of checksum to CB?
The checksum to be submitted to CB in document form or soft copy form.

7.13 Data part includes drone and mission specific data, which requires an update regularly on mission basis. Hence, data part checksum calculation is not feasible. Is checksum calculation for code part alone adequate?(*)
Checksum of the data part which contains Drone specific information and not the mission specific information should also be submitted.

7.14 What parameters comes under data checksum and what parameters comes under code checksum?
The parameters that come under data checksum are manufacturer defined and the code checksum is for the firmware used in the UAS, for example arducopter for Pixhawk cube Flight controller, which is also defined by the manufacture ensuring the firmware tamper avoidance.

7.15 We are currently using a flight controller and companion computer as our Flight Module, with a wired connection between them. According to Annexure E, it is required that the communication between these components should be encrypted. However, we are facing challenges in implementing encryption for the flight controller and companion computer as a flight module. We have implemented secure boot for both flight controller & companion computer. As most of us use open-source flight controller software, so as per our analysis there is no substantial way to do that. We can use mavlink signing but that is also not full proof So does anyone approached to QCI for certification with such combination. If yes, what are you suggesting them?
Implantation is the responsibility of manufacturer. For further clarification reach out to SME in the ecosystem.

7.16 Suppose GPS is replaced by some unauthorized way but the make and model is same, then in that case if we are checking based on make & model software won't fail POST Check. So will it be okay or not? If not suggest a way or example.
Currently manufacturers are complying the hardware tamper avoidance, the manufacturer should take utmost care of using hardware protection mechanisms and appropriate design elements to minimize the tampering of the same.

8. Instruments / Equipment

8.1 How can we check GPS / GNSS receiver, normally testing of GPS for other aerospace products, the GPS normally is tested using a very expensive GNSS/GPS constellation generator connected directly to the GPS antenna ULF/SMA Port, hence do Manufacture need to perform a comprehensive GPS/GNSS performance test or will it be based on performance criteria of drone (Plan of Action)?(**)
It will be based on the performance criteria of Drone. Further, a latitude and longitude of a few representative reference verification points can be marked on the ground and the GPS receiver on board can be verified with respect to these reference points

8.2 What is the altitude from which the drop test is performed? Is the drop height (13-18" as you have mentioned) applicable for all classes of UAVs?(**)

There is no distinction between classes of drones. The drop test is for assessing the capacity of the shock absorbing mechanism.

8.3 What should happen if overcurrent/overheating is detected?(*)
System should have a mechanism to safeguard the motors and components when over current / overheating occurs.

8.4 The communication requirement between Flight Controller and a separate Flight Module needs 128bit symmetric encryption. Would that not be an overkill? (*)
The requirements are given in the scheme and compliance to the requirement as per the scheme is mandatory for certification.

8.5 If the flight controller is imported and cannot be customized as per DGCA requirements as software firmware is concerned, is there any other criteria to fulfil that requirement? Most of the flight controllers will be imported from China.
No. It has to fulfil the certification scheme requirements.

8.6 Is there any company in India that manufactures Flight controllers or remote controllers? (*)
It is within the scope of the manufacturer's responsibility to check such availability in India. The scheme has no scope to suggest / recommend any brand, make, company, import, country etc.

8.7 If manufacture wanted to use an imported flight controller or remote controller and assemble a drone with structure and spraying assembly locally manufactured in India, then what is the procedure for certification?
Same as given in the certification scheme.

8.8 Please elaborate how to test cruise parameters (stage 4)? (**)
Cruise parameters are to be decided and listed in the flight manual by the manufacturer. A test plan to be prepared to test these parameters. Testing to be carried out as per the test plan.

8.9 To what level should independence be verified? Is the independence in safety critical functions enough?(**)
Independence of software and hardware to be verified for mostly for flight as well as safety critical systems / functions.

8.10 ETA approval should be taken by the manufacturer of data link hardware. Why is drone manufacturer burdened with this procedure?(*)
Because it is the drone manufacturer who would decide, select and use the hardware. Accordingly, selection and design of data link hardware is with Drone manufacturers and so is the responsibility of manufacturer to get ETA for the hardware from WPC, DoT.

8.11 If someone is using 4G network as a data link and C2 link, do we still need an ETA certificate?
ETA is for unlicensed bands. For licensed bands like the 4G, the network service provider should be having license to operate in the band being used for C2 link.

8.12 Can the predetermined strategy for C2 loss be RTH straight to home along the straight line path that joins home and current location? (**)

Recovery flight profile to be decided and programmed by the manufacturer. One possible way could be climb to maximum permissible height first and then follow the straight line path..

8.13 If UAS has a range in boundary conditions what is the acceptance criteria of CB.(**)
As specified by the manufacturer in the flight manual.

8.14 Can manufacture use a regular SIM card for terrestrial LTE? Or, are there special SIMs? (*)
Choice of SIM is with the designer/manufacturer.

8.15 For Temperature, w.r.t IS 9000 Part 2 & 3, what should be the duration of the test, i.e., should it be 2/4/16/72/96 hours? Does the verification of test reports from an accredited testing lab submitted by the manufacturer for temperature carried out as per IS 9000 Part 2 & 3 or equivalent standard?
Test to be carried out is as per IS 9000 Part 2 & 3 or equivalent standard in an accredited lab. Temperature range, duration, test profile etc. to be specified by the manufacturer as per their design, role, operating environment and other parameters deemed important. Authenticated test report from accredited lab to be submitted.

8.16 Testing labs need more clarity on battery testing; for e.g. min. and max. Temperature range, etc.(*)
Manufacturer has to specify range and acceptance criteria as per design and specification of the Drone. Any clarity on the test profile to be clarified by the manufacturer.

8.17 Are flashing anti-collision strobe lights necessary, even though UAS operations are limited for agriculture spraying 30m height (AGL) in VLOS range and not flying in controlled airspace?(*)
Anti-collision lights are a safety requirement and hence considered most desirable. However, as per certification standards, it is mandatory for night operation and optional for day (only) operation.

8.18 Opinion: Certification should have categories like A+/A/B/C depending on UAS features mainly on optional features like Collision Avoidance, ADS B- Out, Strobe light, etc. to ensure high grade.
UAS certification scheme has no provision or scope for awarding categories or grading during certification. The optional features are for differentiating the product from customer point of view.

8.19 Different components have different envelopes; for example, motors especially can have different max temperature and humidity range. Do manufacturers need to submit test reports of these individual components or the entire assembled UAV as a whole or both?
Range / limits for environmental testing should be decided as per the temperature and humidity range / specification of the final product (in this case the drone) and required safety margin. If the UAV can be accommodated inside the test chamber, the test can beperformed with UAV as a whole. Else individual components / assemblies are to be tested separately.

8.20 What is the purpose of RFID in the given line item and how is it to be tested? Would just an RFID sticker suffice for this? And if so, is any interface required with the GSM module or would compliance also be given if the RFID & GSM are separate subsystems?

- ➔ RFID is to store and give information regarding the drone like Registration No, manufacturer, Owner, Operator etc.
- ➔ Functional test to be done with the help of a RFID reader.
- ➔ Any RFID shall suffice the purpose.
- ➔ It can be independent or interfaced with the GSM module.

8.21 Is it adequate to have a provision for GSM alone for complying with this criteria?(*)
Both RFID and GSM are individually optional.

8.22 Can you explain role of RFID and GSM module, in Certification criteria i, 8.1, its role and purpose and CB tests? (*)

1. However, as per the certification standards, RFID and GSM Sim is optional. In future, these means may be used for live tracking of UAS.
2. If installed, general operation and verification of its function is within the scope of evaluation by CB.

8.23 Is the design life cycle test as per EMS?
No, not as per EMS. There is no design life cycle test as such specified in the scheme. Verification of Hardware design life cycle has been kept through verification of manufacturers established quality control procedure.

8.24 How do we prove the adequate electrical energy requirement?(*) This is the responsibility of the designer / manufacturer.
Nevertheless, one of the methods could be by analysing and calculating the current drawn by various on-board loads including payload at their maximum limits and then adding a safety margin.

8.25 On the strobe lights point, there was a mention of it being mandated in UAS Rules, however I am unable to find a mention of the lights being mandatory in the Drone Rules 2021. Would Manufacturers still be bound by this line item given its exclusion in the revised rules?(**)
As per certification standards, Anti Collision / Strobe light is optional for day and mandatory for night operation.

8.26 As per conversation with the local RLO of WPC, they are not issuing a separate license for 1090 Mhz, they usually give an overall license for the entire Aircraft when it comes to civil aviation. In addition to this, and the fact that ICAO themselves have dissuaded states from mounting ADS-B out on UAS (https://www.icao.int/NACC/Documents/Meetings/2019/ADSBOUT/ADSB-OUT-M-IP04.pdf) and also the fact that there are currently no guidelines in place as per my knowledge for transmission messages on this frequency, how will the implementation of this component be tested?
Implementation of this component can be tested in liaison with Civil ATC. However, liaising Civil ATC is within the scope of manufacturers' responsibility.

8.27 Is ADS-B OUT required for operating a Small Category UAS in uncontrolled airspace? (*)
All UAS operating above 400 feet (120 m) AGL shall be equipped with SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment.

8.28 Is there any specific test procedure for environment tests because NABL accredited lab does not have any such? (*)
Preparing test procedure / test plan / test profile is not within the scope of the LAB. Test

procedure, test plan, test parameters, limits, acceptance criteria etc. to be prepared by the manufacturer as per the design and specification of the product. Lab will conduct the test as per the test plan and test profile.

8.29 Please mention testing criteria's or parameters for actuators/servo controllers, etc.(*)
No testing criteria for these components has been specified. Manufacturer/designer has to decide which all parameters / specifications are to be tested to ascertain reliable operation / functioning of these components. Accordingly, the manufacturer has to prepare a test plan to test these components for verifying these parameters during ground test or flight test.

8.30 Will relay nodes and/or mesh networks be accepted for the certification process? (*)
Acceptance of such networks are on case to case basis.

8.31 Geo-fencing has been mentioned as a mandatory line item for the certification scheme, however as per my understanding of the revised Drone Rules 2021, geo-fencing is a feature that may be notified in future. Given this understanding, would this line item only be tested once the Central Government notifies Geo-fencing as a mandatory safety feature? (*)
As per Certification standards, Geo-fencing is mandatory.

8.32 Does CB test the Geo-fencing feature also as per the Certification Scheme?
Yes.

8.33 As part of the certification process, will CB also verify the correct operation of the geo-fence checking algorithm, in all cases? or simply check that 1 Hz check of some form is happening?
Besides verifying the 1Hz check being reflected in the log files, CB would check the behavior of UAS on boundary violations or breach of geo-fence in flight tests.

8.34 From a POV of a security loophole, it may be possible to fool a badly implemented geo-fencing. Should the CB verify that?(**)
Yes. CB shall check for correct implementation of geo-fence.

8.35 For the barometer and altitude measurement: For BVLOS operations will an adjustable QNH be considered valid for the subscale setting requirement, if there is a LIDAR rangefinder on-board for measurement of the terrain below the aircraft, can that be considered as an alternative/improvement to the subscale setting?
Subscale setting requirement is for QNH and QFE. These are safety requirements and any incorrect setting is a safety hazard. Adjustable QNH setting meets the subscale setting requirement.

9. Qualification Testing

9.1 Is the design life cycle of hardware (Certification criteria 9.4) determined as per ISO 14001? (*)
It is not mandatory to follow ISO 14001.

9.2 What is IV&V compliance and what should the manufacturer do to demonstrate this?
IV&V is independent verification and validation carried out by a 3rd party. It is a

comprehensive review, analysis, and testing of software and hardware performed to confirm / verify that the product requirements are correctly defined, and that the system is correctly implemented for its intended functionality and security requirements. IV&V report is to be submitted for verification.

9.3 Under Certification criteria 9.3, do the firmware of BMS, etc. should be considered in calculating independence, as they come under software category?(**)
All software used shall be checked for its independence.

9.4 Is there a standard guideline to ensure independence between software components from function and design point of view?
No, there are no standard guidelines or flow chart or template available. However, as designer, the manufacturer has to design the same and carry out necessary analysis of their product and establish that the software components used for various equipment / functionalities are independent from a safety and reliability point of view.

9.5 In Certification criteria 9.1, a), the Effects of voltage spikes from power source should the verification of testing required from the accredited testing lab, if the power source is battery only? (**)
No. Not necessary. Manufacturer to submit a comprehensive technical analysis report on power budget and consumption pattern by various loads including payloads at various flight conditions and bring out that there is no possibility of occurrences ofvoltage spike.

9.6 Certification criteria 9.3 b., if the Flight Controller is in a closed loop system dependent on sensor fusion, how does the Statement of Independence between software components fit here? Does that mean Unit Testing/Integration Testing of the software? (**)
Yes. Testing of software as well as hardware.

9.7 For EMI/EMC test: (Radiated Immunity) IEC 61000-4-3, what should the frequency range (80MHz-1GHz/ 1GHz-3GHz/ 80MHz-3GHz) and level (1V/m/ 3V/m/ 10V/m) be? Is the verification of test reports from an accredited testing lab submitted by the manufacturer for Radiated Immunity carried out as per applicable Parts and Clauses of IEC 61000 / IS 14700 or equivalent standard?
Yes. Based on the design, specifications like sensitivity, electrical bonding, electronics circuit, filters used etc. manufacturer has to specify the frequency ranges for testing and acceptance limits.

Considered recommendations:
Frequency Range

9.8 Since the UAS is always transported in a carry case, would it be sufficient to carry out the shock test with the transportation case containing the UAS?(*)
No. The shock test is to be done on the specimen, i.e., UAS in unpacked condition or without packing / transportation case. The test is to be carried out as per the provisions of IEC 60068-2-27.

9.9 For Humidity, IS 9000 Part 4, what should the duration of the test be, i.e., should it be 12/16/24 hours or 2/4/10/21/56 days? Is the verification of test reports from an accredited testing lab submitted by the manufacturer for humidity carried out as per IS 9000 Part 4 or IEC 60068–2–78 or equivalent standard?

Test to be carried out as per IS 9000 Part 4 or equivalent standard in an accredited lab. Equivalent Standard is IEC 60068-2-78. Humidity range, duration, temperature, test profile, etc. to be specified by the manufacturer as per their design, role, operating environment and other parameters deemed important. Authenticated test report from accredited lab to be submitted. General recommendation is Humidity 93% at +40°C

9.10 For shock resistance, IEC 60068-2-27, what should the shock pulse (Half sine/Triangle/Trapezoid/Square), Pulse amplitude, and Pulse width be?
Based on the design, specification, usage, life cycle etc. of the UAV, the manufacturer has to specify the shock test profile like pulse shape, duration, amplitude, number of shocks, axes etc. Test to be carried out on a vibration or shock table. A test plan with a test profile is to be prepared by the manufacturer and given to the lab. The lab shall carryout tests as per the test plan. Shock test to be carried out without packing case.

: 80 MHz to 3 GHz
Level: 1V/m

Since the UAS uses internal power from the battery, only sub-clause IEC 61000-4-3 is considered applicable. IS 14700 is equivalent to IEC 61000.

9.11 How do manufacture plan for temperature/humidity and EMI/EMC test? Should it be done for components separately or UAV as a system? (*)
If UAV can be accommodated inside the test chamber, then the tests can be performed as a system. Else, the test is to be carried out for each component.

9.12 Wherever it's written "CBs to witness bench test", will the CBs witness the bench tests at NABL Accredited lab or an in-house bench setup? (**)
Tests that are to be carried out in accredited labs are generally mentioned in the scheme as “Lab Test”. Unless specified, CBs shall not witness the tests in NABL accredited labs. CBs shall witness only the in-house bench setups and tests.

9.13 What about the certificate of the test bench where some in-house tests are to be done? Would self-certification work? (*)
No, self-certification won’t work. Details of test benches are to be vetted by CBs for adequacy. If found adequate, CB shall witness the test or accept the test results.However, instruments used for monitoring / measuring parameters in the test bench should have a valid calibration certificate traceable to NABL or National/International standards.

9.14 Is it good-to-have or a must requirement for suppliers to have a standards based QC management process? Can they have a custom QC process? (*)
Suppliers can have their own documented Quality Management System (QMS) in reference to any International Standard such as ISO 9001 or AS 9100 or regulatory standards such as Civil Aviation Requirements of DGCA, Federal Aviation Requirements of FAA, etc., and demonstrate compliance to their own QMS. However, Third Party Certification for either ISO 9001 or AS 9100 is not a requirement at present.

10. Documentation

10.1 In Certification criteria 10.4 (5), for compliance criteria of independently verified and validated reports, the exact requirement was not understood. Is it a controlled list containing all the hardware and software used in the product?

Independent Verification and Validation commonly referred as IV&V is required to be done by a 3rd party. This is to verify both software & hardware to check that the product is built correctly and is capable to perform all intended functions and that it does not perform any unintended functions. To carry out IV&V, a test plan /test-cases covering all functionalities should be prepared. Software and hardware to be tested as per the test plan. Submission of IV&V report is a stage-1 compliance requirement.

10.2 In Certification criteria 10.4 (6), for compliance criteria of Material Manufacturing Record, the exact document to be submitted was not understood. Is it a controlled record indicating the source & method of procurement of all the components used in the product?
The requirement is on providing Material Procurement Records duly authenticated by organization authorized representatives. The intent is to record sources of supply and maintain consistency in quality of procurements.

10.3 Would integration document and stage-wise QC report be sufficient for compliance?(**)
Yes, in case the fabrication method is established one.

10.4 Can we upload the design documents (para-wise) in the analysis report section as no separate portal is there to upload design documents?(*)
No. Design document is to be submitted to CB

10.5 In case of agriculture drone do we need to address leak proofing requirements as a caution note? (*)
In case of agriculture drone, manufacturers should add the leak proofing requirements as a caution note in the user manual so that operator may take care of leakage during operations.

10.6 How manufacturer will own the responsibility of their documents/records/reports?

1. All the documents owned by manufacturer should be signed by appropriately authorized person(s).
2. All the in house test reports submitted by manufacturer should be signed by appropriately authorized person(s).
3. All NABL Lab test reports witch is submitted by manufacturer should be counter-signed by appropriately authorized person(s)

11. Other Key Aspects

11.1 At what stage lab certifications are required for various components?
Lab certification, wherever required, is mentioned against the applicable clauses in the certification scheme. All test need to be conducted prior to submission of D1 application to ATE

11.2 If UAS is so useful then why does the Indian government place this much restriction on manufacture?
There is no restriction on manufacturing as such. However, it is utmost important that any product manufactured has to meet minimum safety standards to ensure safety of the people product and the aviation ecosystem.

11.3 Once the product has passed the Certification and already out in the market, and if we have a new firmware update what is the next step do we again need the certification as it

is just a firmware update on the existing version
Any changes effecting to the Type Certificate (parameters)/ Datasheet (UAS specifications), the manufacturer shall approach ATEs (CBs). ATE's shall process these changes through "change of scope". Any such changes proposed by the applicant including flight manuals/ operating manuals/ software upgrades etc. shall be reviewed by ATEs for conformance as per CSUAS.ATEs shall submit the updated/revised SoC pack to DGCA for their cognizance.

11.4 From the RPTO point of view, what types of repairs need to be reported? During training flights, chances of small component damage is fairly high, i.e., change of propellers, motors or ESCs.
It is a good practice to document all types of repairs carried out and retain records. Flow down of this information to the manufacturer is necessary for continuous improvement of the product quality and performance. If you mean reporting to DGCA, the requirement is all UAS holders shall maintain maintenance records and, should be able to produce on demand by DGCA.

11.5 Where can we get list of NABL accredited labs for different components? Is there any helpline who can support in the process?
NABL accredited labs can be found on official website (https://nabl-india.org/nabl/index.php?c=searchlab&m=index&Itemid=177)

11.6 When we talk about independent witness testing by CB, in case of NABL lab unavailability, can you put more light on compliance to check at manufacture lab?
In case of unavailability of NABL Lab, try find a Government approved or DGCA or DGAQA (Directorate General Aeronautical Quality Assurance) approved lab. In the event of unavailability all these approved labs, the tests can be performed at the manufacturer's lab. For this you need to ensure the test bench and all the instruments/ gauges attached to the test bench are calibrated at an approved lab, maintain all calibration certificates, have documented test procedure and a format to record test results. Provide basic training to people conducting the test and maintain their training records. The tests can be demonstrated to the CB during onsite assessment

11.7 Is there any separate approval to be done for manufacturer lab with respect to standard applicable for lab?
As far as labs are concerned, they can be grouped into two categories namely "Captive Lab" and "Test House".
A captive lab is a full-fledged lab within the manufacturer's facility without a NABL approval, this lab can perform testing for their own products, and they are not entitled to perform any test and release / issue a test report for any outside company.
A Test House is an independent and NABL approved lab carrying out only inspection, calibration and testing functions for manufacturer's products and they are authorised to release/issue test reports which are acceptable to customers, government, certification bodies and regulatory authorities. Majority of the manufacturers prefer to test their products at NABL labs rather than investing for in-house test setups. ISO 17025 is the international standard for testing and calibration laboratories. It's a set of requirements those laboratories use to show that they operate a quality management system and that they're technically competent to do the work that they do. All NABL approved labs are certified to ISO 17025 standard.
If you get your Captive Lab NABL approved, you would have two benefits: 1. you can perform testing on your products and issue test report which would be acceptable to CB,

CB may not insist for testing it again in their presence. 2. You would be entitled to perform testing and issue test report for products of other manufacturers, adding revenue to your business.

11.8 In future, is there a plan to have designated labs for independent testing instead of allowing self-tests on-site? Will there be separate approval process for such independent labs or any NABL accredited lab will be allowed?
As far as labs are concerned, they can be grouped into two categories namely “Captive Lab” and “Test House”. A captive lab is a full-fledged lab within the manufacturer’s facility without a NABL approval, this lab can perform testing for their own products,and they are not entitled to perform any test and release / issue a test report for any outside company. A Test House is an independent and NABL approved lab carrying out only inspection, calibration and testing functions for manufacturer’s products and they are authorized to release/issue test reports which are acceptable to customers, government, certification bodies and regulatory authorities. Majority of the manufacturersprefer to test their products at NABL labs rather than investing for in-house test setups. ISO 17025 is the international standard for testing and calibration laboratories. It's a set of requirements those laboratories use to show that they operate a quality management system and that they're technically competent to do the work that they do. All NABL approved labs are certified to ISO 17025 standard

11.9 How to go about testing unconventional drone designs? Will the same rules apply?
Yes, same rules will apply for testing unconventional drone designs.

11.10 If the manufacturer has multiple locations (Design office, Manufacturing location etc.), all location shall be included in the certification? If some of the processes are outsourced (design, fabrication, sub-assembly etc.) the audit scope of limited to manufacturer or it is extended to the outsourcing suppliers too?
You should clearly mention these locations, the work carried out and show it on company organisation chart and their link to the ultimate organisational head responsible for business execution. During the initial assessment all locations will be audited to for their function. As far outsourcing is concerned, it is the responsibility of the supplier to control its sub-tier suppliers and the process of control to be defined in supplier’s QMS, CB will verify compliance to this procedure. Please note that outsourcing work to another organisation does not absolve supplier of the responsibility to provide acceptable products.

11.11 Is there a list of approved third party test vendors which we can contact?
No such list is available. It is the responsibility of the manufacturer to find and arrange 3rd party test vendors

11.12 If we assemble a drone, then also we need all the tests/certification?
It depends on the purpose of operation and size. Compliance is required as per Drone Rules 2021

11.13 Is there any certified components list?
No. Component list to be prepared by the manufacturer as per category, design, specification, payload etc. of drone

11.14 As a farmer producer company what things need to be checked from UAV manufacturers ?

Providing any advice on this is beyond the scope of scheme owner's responsibility. However, specification, capability, role etc. could be checked against requirements of the farm producer company

11.15 Can QCI/DGCA give us a draft document required to be submitted for certification? It will help us write the documents and speed up the certification process.
There is no scope for draft or sample document within the purview of certification scheme. It is the responsibility of the manufacturer to design documents for their productthat meet the requirement of certification.

11.16 What's the type of approval for conceptual and development drones by a start-up?
Approval requirements for conceptual and developmental drones wherever applicable,are given in the part VIII of Drone rules.

11.17 Any specific certification requirements for BVLOS operations?
BVLOS certification requirements are under preparation and shall be released in due course of time.

11.18 What is the procedure for demonstrating datalinks for BVLOS operations?
BVLOS certification requirements are under preparation and shall be released in due course of time.

11.19 Which accredited lab can certify Autopilot systems? Certification of Autopilot is not part of CSUAS requirements.

11.20 In the case of drones having more safety features, there should be some safety rating like automobile for Ex-NCAP rating.
The present Drone rules and certification scheme has no scope for rating or grading of drones.

11.21 How foreign manufacturers export UAS to India without certification from CB/DGCA? If the UAS is procured from a foreign company, in that case what will be the procedure
Please refer Rule 10 &11 of Drone Rules, 2021

11.22 The validity of the NABL Accredited labs report?
The report should not be more than 6 months old from the date of application submitted on Digital Sky Platform.

11.23 Can foreign manufactures apply for type certificate under Certification Scheme for UAS?
Manufacturers conforming to Indian legal entity requirements can only apply under CSUAS.

11.24 What action can QCI take on misrepresentation of the information submitted or any other malpractices used to demonstrate compliance against the scheme requirements by the Manufacturer?
QCI can take actions against the manufacturer as per policy defined the governing structure of the CSUAS, including legal/criminal proceeding.

11.25 Manufacturers should give reference of DGCA/QCI in their design documents?
No, manufacturers should not give the reference of DGCA/QCI in their design document, manufacturers shall freeze their design documents before submitting to ATEs/CBs.

11.26 Is there any additional guidelines/circular available on QCI website?
Yes, you may visit QCI Website (https://qcin.org/certification-scheme-for-unmanned-aircraft-systems-(uas))

11.27 What should be the base for manufacturers to declare self-certification?
Self-certification of the drones by the manufacturers is not envisaged in the scheme. However certain parameters shall need to be determined/checked by the mfr and make a declaration to that effect. Critical amongst these parameters shall be reverified/ validated by the CB during the certification process.

11.28 Who should be digitally signing the company documents (PAN, GST etc.) to upload on the digital sky platform?
Company (Applicant/Manufacturer) to decide and designate the authorised signatory.

11.29 What CB should do if there is any observation given by lab on test reportCB should review the same in line with scheme requirements.

11.30 Whether draft test report issued by Lab can be accepted by ATE
No

11.31 Any documents need to signed by ATE?
1. Evaluation report, flight test witness report and any other witness report should besigned by ATE
2. SoC should be signed by ATE
3. Any other documents owned by ATE should be signed

11.32 What is Elevation?
The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level [SOURCE: ISO 23629-7:2021, 3.4]

11.33 What is Visual Line-of-sight operation?
VLOS UAS operation in which, the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the unmanned aircraft in relation to other aircraft, people and obstacles for the purpose of avoiding collisions. [SOURCE: European Commission Regulation 2019/947]

12. Responsibilities of Manufacturers and ATE's after issuance of Type Certificate

12.1 After Certification, if a manufacturer wants to add additional models, again initial certification (stage 1 and stage 2) to be followed?
Depend on the nature of change, ATE to review and process accordingly

12.2 What happens in the case when parts, components, software need to be upgraded, changed? Is there a new certification process from beginning or only for that part or not necessary?
After the initial design approval by the design approving authority-DGCA, any upgrade, change to the product resulting in design and configuration changes should be submitted

to the authority for approval of the changes. As far as certification is concerned, ATE will verify compliance with respect to the changes incorporated and the updated SoC shall be submitted to DGCA by ATE

12.3 Any incident or accident could take place either due to malfunction in the system, due to pilot error and due to change in weather parameters not ascertained or paucity of time to abort flight. Further the failure may lead to catastrophic effect or may not in all the cases as manufacturers would need to find the reasons from the storage data for further improvement in the system.
Yes. Analysis of every failure both in-house and customer feedback is very much needed for continuous improvement of manufacturers processes, products and system.

12.4 Any Updates, Accident, Failures by the manufacturer/ User need to be informed to CB.
Yes

12.5 When should we renew the agreement/SoC
Should be renewed 3 months prior from the expire date.

13. Additional queries on CSUAS

Clause 1:

13.1 How are the analysis document for calculating CG verified? Is it necessary to verify the calculation of CG for all configurations of the UAS? In case, if the CG values differs for each configuration what control the ATE should ensure?

The details should be provided by mfg.

The C.G limits as per design:

1. Without payload: Limit of X,Y & Z axis
2. Maximum take-off weight: Limit of X,Y & Z axis
3. If applicable (different payload): Limit of X,Y & Z axis
    a. With Configuration 1.
    b. With Configuration 2.
4. CG in various configurations should not cross the defined limits by the manufacturer.

13.2 What is the evaluation method carried out to verify the design document determining the life of the airframe of the UAS? In case, if FEA analysis is being submitted, what are the parameters that are being verified? and how ATE are validating the maximum life claimed by the manufacturer?

FEA analysis and traditional way of submitting the full time record of the UAS i.e. design, flight logs, supporting evidence of the flights with the specific aircraft.

1. FEA report should have all information like nodes, meshing, boundary condition, material property, and all other inputs considered in the FEA analysis.
2. It should be listed / explained in the analysis report. Analysis report should have purpose, methodology, explanation of result and importantly final findings / conclusion.
3. FEA analysis data is a theoretical estimation. For safety reason, manufacturer can set a life lesser than the theoretical life.
4. The maximum life may be calculated using the following logic:
    a. Maximum life of airframe by FEA
    b. Reduce the same for factor of safety of 1.5x
    c. Calculate operational life of UAS with respect to other components
    d. If it envisaged that operational life can be extended then the life of critical components overhauling, maintenance and replacement, for such component should be defined (such life extensions shall not be more than defined life of airframe)

13.3 What are the evaluation method that is being carried out if the UAS has multiple payload configuration?

1. The addition or removal of such payload shall not change the fundamental performance, characteristics or behaviour of UAS:
    a. The payload should be easily swappable.
    b. Classification of the UAS shall not be changed
    c. Weight variation from MToW(below) is allowed upto maximum of 5% of MToW this includes all the different configuration of payloads and manufacturing tolerances.
    d. C.G shall be within the defined limits for each payload of UAS

e. There should not be major deviation in Endurance
f. Endurance of UAS should be calculated with each payload
g. Flight test (Annexure D, part 3 of CSUAS) should be performed with each payload in stage 2 by ATEs

2. Manufacturer to calculate C.G limit (travel of CG in all axis. Further needs to determine the CG values at each operational condition that may occurs in operation of UAS in design document.
3. Verification of design documents of each payload i.e., which includes weight, design, C.G limits and detailed information of the payload along with others UAV performance characteristics with that payload like range, endurance etc. and each configuration details shall be defined in manuals by manufacturer
4. The MToW values should remain constant in the design document irrespective of different configuration and the MToW shall be used for all analysis, lab testing, FEA for calculation.
5. ATE shall verify what will be delivered to customer as a finished product in a packed box i.e., user manual shall be submitted by the manufacturer defining with all the details of UAS, all associated payload and accessories if applicable during stage 1 to ATEs

Clause 2:

13.4 What are the methods of evaluating the range of the UAS during witness?
Till the UAS is maneuvered visually w.r.t orientation.

13.5 How is the endurance of the UAS claimed by the manufacturer is validated during flight test by ATEs? If the endurance of the UAS is said to be 20 minutes what is the parameter of the battery of the UAS that has to be verified with NABL test report during flight test?
Take off time and battery voltage/average current; Landing time and touch down voltage; verification of touch down voltage w.r.t to the inputs given by the manufacturer given to NABL for conducting batter performance test.

13.6 While conducting the stability and control flight test, what are the functionality of UAS that is being verified? what are the parameters of the UAS that has to be verified? is it conducted with MTOW?
1. Demonstration witnessed in both operating mode Flight Control Systems augmented or Manual (if applicable)
2. Demonstrations of failsafe features longitudinally, directionally and laterally stable in any condition.
3. UAS with payload (MTOW) and with every configuration of payload should be demonstrated.

Clause 3:

13.7 What are the parameter of the battery verified from the NABL test report for discharge rate of battery?
The following are observed in the NABL test report:
a. C-rate
b. Cut off conditions
c. Ah
d. Wh
e. Energy and power density.

Name of document and original test report is verified during the witness assessment.

13.8 During stage 2, how are ATEs ensuring that the UAS is utilizing less than 90% battery of a fully charged battery after landing? What are the battery failsafe mechanism described by the manufactures are being verified?

1. Verification of the inputs given by the manufacturer as the low voltage to NABL for conducting life cycle calculation test.
2. Battery voltage warning as failsafe mechanism; first critical voltage warning to hover and second critical voltage warning to land/RTL

Clause 4:

13.9 What are the methods of evaluating static load on a structural element? what parameters does ATEs verify Load Factor ?

1. Theoretical document verification
2. Actual static load application to flight limit load for a specified duration as designed by the manufacturing from the design document
3. Input to FEA analysis should include environmental condition, limit load. 1.5 factor of safety to be ensured.

13.10 What are the methods of evaluating that UAS is free from excessive vibrations under any operational speed and power condition in stage 1 & stage 2?

Verification of the design document submitted by the manufacturer the vibrational limits are as following:

1. In X axis: “Value”
2. In Y axis: “Value”
3. In Z axis: “Value”

During the witness assessment the values which has been derived from the flight log after the flight test, the vibrations are found as following:

1. In X axis: “Value”
2. In Y axis: “Value”
3. In Z axis: “Value”

Therefore, ATEs can justify the vibrations are in defined limits, hence it is compiled to the scheme requirements.

Clause 5:

13.11 Special process, what do you understand by Special process? what are likely the objective evidences for quality control during manufacturing?

Special process are the manufacturing oblique assembly processes whose quality cannot be evaluated using NDT testing. That is Destructive test are needed for checking the quality. towards this some critical key prams, objective evidences would need to be collected during the manufacturing oblique assembly processes.

For example: during heat treatment the temperature oblique duration at which the material is kept and the environment.

Some application of glue would need curing time undertaking further assembly.

13.12 Effect of temperature and moisture should be determined in computing the material design values; explain the objective evidence to be collected against for this requirement.

Temperature and humidity test report from NABL lab report submitted by the manufacturer and following values has been identified from the report:
Temp: value
Humidity: value test

Example: Further, if the drone has not been tested at -10 to 50 degrees, then manufacturer to give justification as to why a different limit has been chosen

Clause 6:

13.13 What are the evaluation methods of the full functioning of data link communication?

1. Verification of ETA certificate/licence by WPC is required for each module used for communication (C2 data link, frequency band, etc) in UAS.
2. Witnessing data link for distance communication in all azimuth angles and maximum altitude and range “values”

13.14 What are the methods of evaluating the communication range is sufficient to have a permanent connection with the UAS?

1. Verification of specification that the actual transmitter used in the design is same as in the ETA.
2. Witnessing data link capability for demonstrating flight parameter like, altitude, speed distance battery status signal strength was updated on GCS screen.

13.15 Method of evaluating the system to alert the remote pilot with aural and visual signal, for any loss of command and control data link and if data link is lost or in other contingencies

1. Verification of associated test reports to ascertain implementation of the functionality
2. Witnessing compliance to the scheme requirements during flight test (snapshots/video attached)
    a. The Aural and visual warning was visible and audible from the GCS during the signal lost
3. Witness the RTH when data link was lost.

Clause 7:

13.16 How are ATEs ensuring the protection of onboard computer firmware from tampering (software)

1. ATE to collect code digitally signed code checksum and data checksum from manufacturer.
2. Verify if manufacturer has used a private & public key combination to ensure that user cannot tamper the firmware.
3. Witnessing the procedure of tamper proof once firmware uploaded cannot be decrypted unless authorized private key provided is demonstrated by the manufacture.

13.17 How are ATEs ensuring the protection of onboard computer from tampering (physical)

1. Verification of procedure for hardware protection through flowcharts & pictorial representation, the location where all hardware tamper avoidance has been incorporated.
2. ATE to confirm whether any standard tools or special tool recommended by the manufacturer

13.18 What methods are acceptable for hardware tamper proofing?

Acceptable methods for hardware tamper proofing include the use of pressure switches or GSM SIM cards to detect hardware tampering, the use of void tape, or any other credible method. The specific locations and installation details of these systems should be clearly mentioned in the design drawing or documented.

13.19 Is there a documented procedure for replacing crucial hardware such as radio modules, GPS, and flight controllers?

1. Yes, there is a detailed Standard Operating Procedure (SOP) provided for the replacement of crucial hardware.
2. Additionally, post-replacement functional checks of the critical hardware have been outlined in the document and verified and accepted.

13.20 How is the protection of the onboard computer from physical tampering ensured?

The protection of the onboard computer from physical tampering is ensured through the use of hardware tamper avoidance mechanisms. The manufacturer has employed a specific method, which is documented in detail through flowcharts and pictorial representations. The method used may involve features such as pressure switches, GSM SIM cards, void tape, or other credible methods.

Clause 8:

13.21 What are the requirements for compliance regarding onboard electrical and electronics equipment?

The requirements for compliance regarding on-board electrical and electronics equipment include:

a. Adequate source of electrical energy for operation.
b. Wiring installed in a manner that does not adversely affect the simultaneous operation of other equipment.
c. Wiring layout according to the wiring diagram.
d. All wiring suitable for the current and voltage passing through it.
e. Absence of kinks in the wiring.
f. Wiring routing away from sharp edges.
g. No soldering connections between cables.
h. Adequately secured connections to prevent loosening during vibrations.
i. Minimum operating voltage specified.
j. Maximum operating current specified

13.22 What aspects of the all-on-board electrical equipment were verified during the witness assessment?

During the witness assessment, the following aspects of the all-on-board electrical equipment were verified:

a. General wiring layout.
b. Wiring carried out as per the wiring diagram.
c. Absence of loose cables.
d. Tied looms.
e. Absence of kinks or bends near sharp edges.
f. No soldering connections between wires.
g. Secured connectors.
h. Charging connectors checked for reverse polarity.
i. General layout of systems and wiring.

13.23 What additional requirements should the manufacturer fulfil regarding the wiring diagram and electronic/electrical component certification?

The manufacturer should fulfil the following additional requirements:

a. Prepare a wiring diagram showing the electrical interconnection of all components.
b. Include in the design documents or wiring diagram the specification of all cables/wires used, including their current carrying capacity and the signal or current they carry.
c. Mention other common points as per the clause in the design documents.
d. Consider seeking SIL (Safety Integrity Level) Certification for onboard critical electronic/electrical components from the manufacturer.

13.24 If flashing anti-collision strobe lights are mandatory for night flight operations as per the scheme, what are the evaluation method carried out by the ATEs?

Verification and witnessing the following:

If the UAS is for night operation, then the manufacturer should clearly bring out the following:

a. How to determine orientation of the UAS at night using the strobe light.
b. SOP for night flying
c. What is the range night
d. Payload during night flying

13.25 How ATEs would evaluate the range of UAS at dawn and dusk when the sun is below the horizon?

There is no clear guidelines or provision of how the range of the UAS can be determined at dawn or at dusk nor there is any rule of air for determining the visual range at this hour.

13.26 Does the GPS receiver meet the requirements and functionality of the UAS?

1. The details of the GPS submitted by the manufacturer in the design document indicate whether the GPS receiver meets the requirements and functionality of the UAS.
2. Additionally, during the witness assessment flight test, the manufacturer conducted way point navigation according to their defined procedure. The test results were found satisfactory, and snapshots and flight logs are included in the report.

13.27 What information should be included in the design document regarding the GPS receiver?

The design document should include the following information regarding the GPS receiver:

a. GPS make and model.
b. Specifications of the GPS receiver.
c. Accuracy of the GPS receiver.
d. Latency of the GPS receiver.

13.28 Were the GPS make, model, specifications, accuracy, and latency mentioned in the design document?

The design document should specify the GPS make, model, specifications, accuracy, and latency. To verify this, the details of the GPS submitted by the manufacturer in the design document can be examined.

13.29 How is the orientation of the UAS determined at night using the strobe light?

The manufacturer should provide information on how to determine the orientation of the

UAS at night using the flashing anti-collision strobe lights. This could include details on the specific configuration or pattern of the strobe lights that helps identify the UAS's orientation.

13.30 What is the Standard Operating Procedure (SoP) for night flying with the flashing anti-collision strobe lights?

The manufacturer should clearly outline the Standard Operating Procedure (SoP) for night flying, specifically addressing the use of the flashing anti-collision strobe lights. The SoP should include guidelines for the activation, positioning, and proper functioning of the strobe lights during night operations.

13.31 What are the parameters related to night flight that have been verified during the witness assessment flight test report?

The witness assessment flight test report should include the following parameters related to night flight that have been verified:

a. The method for determining the orientation of the UAS using the strobe light.
b. The Standard Operating Procedure (SoP) for night flying.
c. The night range of the UAS.
d. Lux meter readings to measure the intensity of the strobe lights.
e. Any specific considerations or restrictions regarding payload during night flying.

13.32 Have the actuators, servo controllers, and other components been installed in the UAS?

1. The design document submitted by the manufacturer, should provide information regarding the installation of actuators, servo controllers, and other components in the UAS.
2. Additionally, the witness assessment flight test verified the presence of these components.

13.33 Has the UAS implemented the geo-fencing capability?

1. The implementation of the geo-fencing capability should be determined by examining the submitted design document.
2. Further, during the witness assessment flight test, the geo-fence was created before the flight and verified in both manual and automated modes to ensure that the UAV did not breach the boundaries. Snapshots and flight logs supporting this verification are attached in the report.

13.34 What should be mentioned in the design document and flight manual regarding the definition of the fence for the geo-fencing capability?

1. The design document and flight manual should clearly specify how to define the fence for the geo-fencing capability. This information should be included as part of the documentation and guidelines provided by the manufacturer.
2. Additionally, a report of the geo-fencing test should be attached as objective evidence, further validating the functionality and effectiveness of the geo-fencing feature.

13.35 Is the UAS equipped with an SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment?

To determine whether the UAS is equipped with an SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment, it should be verified if the UAS intends to operate above 400 feet Above Ground Level (AGL) and if it operates in controlled airspace, UAVs operating in controlled airspace are required to have an SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment.

13.36 What are the requirements for UAS operating above 400 feet AGL in controlled airspace?

UAS operating above 400 feet AGL in controlled airspace are required to have either an SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment. These technologies enable the UAS to transmit its position information to air traffic control and other aircraft for enhanced situational awareness and airspace coordination.

13.37 What are the benefits of having an SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment for UAS operating in controlled airspace?

Having an SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment for UAS operating in controlled airspace provides several benefits, including improved surveillance and tracking of the UAS by air traffic control, enhanced safety by allowing other aircraft to be aware of the UAS's position, and better overall airspace management and coordination to avoid potential conflicts between UAS and manned aircraft.

13.38 Has the Detect and Avoid (D&A) capability been implemented in the UAS?

1. To determine whether the D&A capability has been implemented in the UAS, the S-1 documentation review should be conducted.
    a. the values of parameters such as the make and model of the D&A equipment, specifications,
    b. range of detection,
    c. sensors used,
    d. principle of operation,
    e. field of view (FoV) covered by the D&A.
2. During witness assessment, test procedure to be conducted the as per the flight test mentioned in design document.

13.39 What information should be included in the design document regarding the D&A capability?

The design document should include the following information regarding the D&A capability:

a. Functioning of the D&A system.
b. Make and model of the D&A equipment.
c. Specifications of the D&A equipment.
d. Range of detection of the D&A system.
e. Sensors used in the D&A system.
f. Principle of operation of the D&A system.
g. Field of view (FoV) covered by the D&A system.

13.40 Does the UAS have a flight controller with flight data logging capability?

To determine whether the UAS has a flight controller with flight data logging capability, the data log of the flight test conducted during the witness assessment should be verified. The attached data log in the report can provide evidence of the presence of flight data logging capability.

13.41 What does the flight data logging capability entail for the UAS?

The flight data logging capability of the UAS allows for the recording and storage of important flight data during operations. This can include parameters such as altitude, speed, GPS coordinates, control inputs, sensor readings, and other relevant information that helps analyse and assess the performance and behaviour of the UAS during flight.

13.42 How was the flight data logging capability verified during the witness assessment?
The flight data logging capability was verified during the witness assessment through the analysis of the data log generated during the flight test. By examining the data log attached in the report, the presence and functionality of the flight data logging capability can be confirmed, allowing for the review of the recorded flight parameters and other relevant flight data.

13.43 Does the UAS have barometric equipment with the capability for remote subscale setting?
To determine whether the UAS has barometric equipment with the capability for remote subscale setting, it should be verified if the UAS is intended for BVLOS (Beyond Visual Line of Sight) operations. Barometric equipment with remote subscale setting enables altitude tracking during flight and the ability to set flight level, altitude (QNH), and height (QFE) remotely from the Ground Control Station (GCS). This capability is recommended for drones operating in controlled airspace and for BVLOS categories due to its safety features and the importance of maintaining correct altitude separation.

13.44 Why is barometric equipment with remote subscale setting important for UAS operations?
Barometric equipment with remote subscale setting is important for UAS operations as it enables accurate altitude tracking during flight. Additionally, it allows for the setting of flight level, altitude (QNH), and height (QFE) remotely from the GCS. This capability ensures proper altitude separation, especially in high-density flying areas and BVLOS operations. Failure to set the appropriate barometric sub-scale pressure may lead to significant deviations from the cleared altitude or Flight Level, which can compromise safety.

13.45 What are the benefits of having barometric equipment with remote subscale setting for drones operating in controlled airspace and BVLOS categories?
Having barometric equipment with remote subscale settings for drones operating in controlled airspace and BVLOS categories offers several benefits. It enhances safety by enabling accurate altitude tracking and facilitating remote adjustment of flight level, altitude, and height. This capability ensures compliance with altitude separation requirements, aids in maintaining safe distances from other aircraft, and contributes to overall airspace coordination and safety.

13.46 Does the UAS have provisions for RFID and GSM SIM cards?
To determine whether the UAS has provisions for RFID and GSM SIM cards, it should be verified if these features are included in the UAS. The presence of RFID and GSM SIM Card provisions would indicate that the UAS is equipped with the capability to utilize RFID technology and GSM network connectivity.

13.47 What is the purpose of RFID and GSM SIM Card provisions in the UAS?
RFID and GSM SIM Card provisions in the UAS can serve various purposes. RFID (Radio-Frequency Identification) technology can be used for asset tracking, identification, and data transfer within the UAS system. The GSM SIM Card provision enables the UAS to establish communication and connectivity through the GSM network, allowing for remote monitoring, control, and communication capabilities.

13.48 How are the RFID and GSM SIM Card provisions implemented in the UAS?
The implementation of RFID and GSM SIM Card provisions in the UAS would depend on

the specific design and requirements. These provisions may include hardware components such as RFID readers, antennas, and GSM SIM Card slots integrated into the UAS system. The manufacturer's documentation or design documents can provide further details on the specific implementation of these provisions in the UAS.

13.49 Does the UAS have provisions for RFID and GSM SIM Card?
The presence of provisions for RFID and GSM SIM Card in the UAS can be determined by examining the UAS system and its documentation.

13.50 What is the purpose of RFID and GSM SIM Card provisions in the UAS?
RFID provisions enable asset tracking, identification, and data transfer within the UAS system, while GSM SIM Card provisions allow for communication and connectivity through the GSM network for remote monitoring and control.

13.51 How are the RFID and GSM SIM Card provisions implemented in the UAS?
The implementation of RFID and GSM SIM Card provisions depends on the UAS design and requirements. It may involve incorporating RFID readers, antennas, and GSM SIM Card slots into the UAS system. Specific details can be found in the manufacturer's documentation or design documents.

Clause 9:

13.52 Has the UAS been tested to withstand the effects of voltage spikes from the power source?
The test reports, such as the lab test report and the in-house test report submitted by the manufacturer, should provide evidence of the UAS's ability to withstand voltage spikes from the power source. The reports should include details such as the nominal voltage, current range at various loading conditions, peak current, and other relevant values that have been verified during testing.

13.53 What values were observed during the witness assessment regarding the UAS's ability to withstand voltage spikes?
During the witness assessment, the UAS's ability to withstand voltage spikes should have been verified. The values observed and documented in the report would include the nominal voltage, current range at various loading conditions, peak current, and other relevant parameters.

13.54 What requirements should the manufacturer fulfil regarding the analysis of voltage spikes and power consumption?
The manufacturer should conduct the necessary analysis to demonstrate that voltage spikes are not possible, as shown in the technical analysis. Additionally, the power consumption of each component should be provided, including a graph of current and voltage at all flight conditions, as a supporting document in the analysis. This analysis and documentation ensure the UAS's resilience to voltage spikes and provide insights into the power behaviour of the components under different flight conditions.

13.55 Is the UAS tested and verified to withstand High-Intensity Radiated Fields (HIRF)?
The test reports, including the relevant test report submitted by the manufacturer, should provide evidence of the UAS's ability to withstand HIRF. If the UAS is not designed for

operation in an environment with HIRF, this information should be clearly mentioned in the flight manual.

13.56 What values were identified from the test report regarding the UAS's resistance to temperature and humidity variations?

The manufacturer's submitted test report should provide values for temperature and humidity variations. The specific temperature and humidity values, as identified in the test report, demonstrate the UAS's ability to withstand different environmental conditions. It should be noted that if alternative values are chosen, the justification for those values should be accepted by the ATE and documented in the design document.

13.57 Has the UAS's resistance to shock been tested and verified?

Similar to the previous points, the UAS's ability to withstand shock should have been tested and verified. The test report, which was submitted by the manufacturer and verified during the witness assessment, should confirm the UAS's shock resistance. This ensures that the instruments and equipment can withstand mechanical shocks without significant damage or functional impairment.

13.58 Has the UAS obtained Ingress Protection (IP) certification?

If applicable, the UAS should have undergone Ingress Protection (IP) certification to assess its resistance to solid particles and water ingress. The test reports, similar to the previous cases, would provide evidence of the UAS's IP certification. However, if the UAS is not designed for IP or if the manufacturer has not defined an IP code, this information should be clearly stated in the flight manual.

13.59 Is each electrical instrument and equipment in the UAS protected against Electromagnetic Interference (EMI) from the operational environment to ensure normal operation?

The test report, should provide evidence of the UAS's protection against EMI. It verifies that each electrical instrument and equipment in the UAS is safeguarded against the potential disruptive effects of EMI originating from the operational environment. The test is conducted with the drone in a powered-on condition, and the functionality of the drone is checked before and after the test, with flight logs provided as supporting evidence.

13.60 What precautions are taken during the EMI/EMC test?

1. During the EMI/EMC test, the drone is powered on to simulate its operational state. This allows for an accurate assessment of its susceptibility to EMI from the surrounding environment.
2. Additionally, the functionality of the drone is checked both before and after the test to ensure that normal operation is maintained. The flight logs are provided to document any changes or anomalies observed during the test.

13.61 Why is it important to check the functionality of the drone before and after the EMI/EMC test?

Checking the functionality of the drone before and after the EMI/EMC test is crucial to assess any potential impacts of electromagnetic interference. This ensures that the UAS operates normally and reliably under normal conditions and after exposure to EMI. Comparing the flight logs before and after the test can help identify any changes or abnormalities that may have occurred due to the influence of EMI.

13.62 What does the EMI/EMC test aim to achieve?

The EMI/EMC test aims to verify that the UAS's electrical instruments and equipment are adequately protected against EMI from the operational environment. By conducting this test, the UAS's resilience to electromagnetic interference is assessed, ensuring that it can function normally without being affected by external electromagnetic sources that could disrupt its performance or functionality.

13.63 What is the impact of the loss of function and malfunction of the UAS?
The impact of the loss of function and malfunction of the UAS can be determined by conducting a risk analysis, as outlined in the manufacturer's design documents. The risk analysis report should identify the risks associated with failures of various software and hardware components, assess their safety and reliability, and outline the potential consequences. It should also provide mitigation strategies for managing and reducing these risks.

13.64 How does the manufacturer ensure the independence of software and hardware components in the UAS?
The manufacturer should define a statement of independence between software and hardware components in the UAS. This includes clearly identifying and defining various components and demonstrating how the failure of one component will not affect the operation of others. The design document should provide detailed explanations of the independence of each component, ensuring that there is sufficient separation and isolation to maintain functionality even in the event of failures.

13.65 What is the significance of Independent Verification and Validation (IV&V) in assessing the software and hardware of the UAS?
Independent Verification and Validation (IV&V) is essential for ensuring the quality and reliability of the software and hardware components of the UAS. The manufacturer should define and conduct IV&V processes to thoroughly assess the software and hardware systems. The IV&V report should be included as part of the design documents, providing an objective evaluation of the functionality, performance, and design of the software and hardware, thus ensuring their independence and compliance with established standards.

13.66 How does the manufacturer determine the sufficient independence between software components in terms of both function and design?
The manufacturer ensures the sufficient independence between software components in terms of both function and design by following established best practices and guidelines. This includes defining clear functional boundaries and interfaces between software components to avoid unwanted dependencies. The design document should outline the design principles employed to maintain independence, emphasizing the separation of concerns and modular design approaches. Through careful design and implementation, the manufacturer ensures that each software component can function autonomously and that failures or malfunctions in one component do not adversely affect the operation of others.

13.67 Weather component level EMI/EMC test suffice?
No, the EMI/EMC test should be carried out for the entire UAS model in functional condition. For example: Power on condition during test

Clause 10:

13.68 In UAS Flight manual submitted by the manufacturer, what are the compliance criteria being evaluated by ATEs?

1. Limitations / operating conditions/ operating envelope
2. Normal Procedures, pre-flight checklist, etc.
3. Emergency procedures
4. Performance (at various combination of weight, altitude, temperature and wind conditions)
5. Any other relevant information required for safe operation of UAS

13.69 What do ATEs look in UAS log book?

UAS log book should consist of the following:

a. Provision to maintain UAS Operation Logs
b. Provision to maintain UAS Maintenance Logs.

13.70 How is the hardware design life cycle determined through established quality control procedures?

The hardware design life cycle is determined through established quality control procedures. The manufacturer should provide details of their internal quality assurance and quality control (QA/QC) process, including quality check points, checklists, and records of checks throughout the entire manufacturing process, from raw material to the finished product. These procedures ensure that the hardware is designed and manufactured to meet quality standards and specifications, and that the design life cycle is effectively managed and maintained.

13.71 How is the performance and reliability of hardware components monitored on a continuous basis?

The manufacturer should specify and explain their process for monitoring the performance and reliability of hardware components on a continuous basis. This may include developing standard operating procedures (SOPs) to enhance the monitoring process's effectiveness. The monitoring process should record all failures encountered, conduct root cause analysis, document rectification measures, and implement remedial actions to prevent future occurrences. Both the user level and the manufacturer level should be involved in monitoring component performance. The maintenance manual should include necessary annotations for user-level monitoring, and the manufacturer should prepare a flow chart or proforma to systematically monitor component performance.

13.72 What information should be recorded and documented during the monitoring process of hardware component performance and reliability?

During the monitoring process of hardware component performance and reliability, the manufacturer should record all failures encountered, conduct root cause analysis to identify the underlying reasons, document the rectification measures taken, and implement remedial actions to prevent future occurrences. These records should be maintained at both the user level and the manufacturer level. Additionally, the maintenance manual should include annotations and instructions for user-level monitoring. The manufacturer may also develop a flow chart or proforma to provide a structured approach to monitor component performance, ensuring comprehensive and effective monitoring.

13.73 Why is continuous monitoring of component performance and reliability important for hardware?

Continuous monitoring of hardware component performance and reliability is important to ensure the ongoing functionality and reliability of the UAS. By monitoring component performance, failures can be identified and addressed promptly. Root cause analysis helps to identify underlying issues, allowing for effective rectification measures to be

implemented. This continuous monitoring and improvement process minimizes downtime, optimizes performance, and enhances the overall reliability of the hardware components. It also facilitates learning and enables the manufacturer to take proactive measures to prevent future failures, ensuring the longevity and dependability of the UAS.

Advisory to manufacturers and ATE

Applicants are not supposed to undertake any consultancy, training and advisory services from approved ATEs/CBs/ Evaluators, in case any ATEs/CBs/Evaluators offering consultancy, training and advisory services should be immediately reported to QCI.

It is advised that during the preparation of design documents manufacturer may be advised to ensure the points suggested below to bring in more clarity and to avoid confusion or back & forth observations:

1. Merge/consolidate the related documents to create design document and then subsequently refer the concerned pages for showing compliance against the respective clauses. Thereby, redundancy in documents / number of documents are minimized.
2. Please ensure, the document writing style/ theme/ manner is followed through out.
3. Please ensure, the document is controlled and frozen before SoC/ TC is issued as the case may be.
4. Stage 2 reports are considered as verification/ witnessed reports by the ATE, those are verified/ witnessed and signed by ATE and therefore, cannot be a part of design document. Design documents should be generated by the manufacturer.
5. During preparation/ generation of any kind of report (by manufacturer/ ATE) please following:
    a. Objective/ expected outcome
    b. What is being tested and for what (Pass/ fail conditions)
    c. Who is conducting the test
    d. When it is conducted
    e. What are the boundary conditions/ inputs
    f. Where it is conducted and What are the environmental conditions during the test
    g. Story/ Procedure/ test conducted can be elaborated (but in plain simple language) with more theoretical and practical references [drawing/ picture/ photograph/ audio/ video references/ flight logs/ graphs in legible / readable format etc.].
    h. All numerical values taken in calculation need to be justified even it is an assumed value.
    i. Conclusion at the end of the report whether it is a pass/ fail with justification in brief.
    j. Signed by appropriate person
6. If any flight logs are used, then please mention the details in readable format, and the values to interpret from graph/ logs are self-explanatory.

Note: These FAQs are compiled to help the applicant in obtaining more clarity on various requirements mentioned in the UAS Scheme. In case of any perceived ambiguity arising out of the FAQ text, UAS Scheme text shall prevail.